

ARMY PROGRAMS

Comanche (RAH-66)

The RAH-66 Comanche is a twin-engine, two-pilot stealthy armed reconnaissance/attack helicopter. The Comanche features low observable (LO) composite technologies with retractable landing gear and weapons pylon to achieve a low Radar Cross-Section (RCS) and a unique engine exhaust system to suppress its infrared signature. A five-bladed main rotor and a shrouded tail rotor minimize the acoustic and radar signatures. A fly-by-wire flight control system and fully integrated digital avionics assist in piloting the aircraft. The Mission Equipment Package integrates a radar, a forward-looking infrared sensor, and an image-intensified television sensor for night flying and target acquisition. The Comanche will be armed with the Hellfire missile, 2.75-inch aerial rockets, a turreted 20mm gun, and an air-to-air missile.

As a member of an Objective Force air-ground task force, Comanche units will conduct the following operations: armed reconnaissance, mobile strike, close combat with ground forces, and vertical maneuver. Comanche's primary role in these operations is to collect and share intelligence information and destroy enemy forces. As technology and Objective Force concepts mature, the Army intends to use Comanche to provide on-site command and control of the air-ground maneuver team.

The Army received approval in October 2002 for a sixth program restructuring in order to reduce risk and accommodate emerging Objective Force requirements. The new schedule will add about 30 months to Engineering Manufacturing and Development (EMD), establish a blocking strategy, and reduce the amount of concurrent developmental testing, training, and operational testing. The proposed schedule includes a Low-Rate Initial Production (LRIP) decision in FY07, delivery of an initial operational capability in FY09, and a Full-Rate Production (FRP) decision in FY10.

The Comanche program was designated a Live Fire Test & Evaluation (LFT&E) system in November 1989. The original LFT&E strategy was approved in the fall of 1995, and will be updated in FY03. The revised LFT&E strategy presents a sequential test program, progressing from components to subsystem and ultimately full-up system level. The full-up system level test article will be a Block I production representative aircraft. In addition, it includes the lethality testing required for the new XM1031 20mm projectile.

TEST & EVALUATION ACTIVITY

Testing to date has featured flight-testing of two prototype aircraft, RCS testing of a full-scale model, contractor testing of mission equipment (sensors, antennas, communications, armament) and crew- and team-level simulation events.

LFT&E activities since Milestone II have included the completion of the initial analytical vulnerability assessment and a series of ballistic and structural tests on evolving designs for the main rotor blade, lightweight crew armor, and several tail rotor components. The ballistic effort will provide data to assist in validation/verification of the finite element analysis model of the dynamic structural response of the tail rotor components when impacted by high explosive incendiary projectile. Lethality evaluation planning for the 20mm projectile was also completed.



Testing to date has featured flight testing of the prototype aircraft and crew and team simulation level events.

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TEST & EVALUATION ASSESSMENT

Technical challenges remain for software development, integration of mission equipment, weight reduction, RCS and Infrared signatures, and radar performance. However, with both time and funding added to the program by the restructure, these high-risk areas now appear to be at a manageable medium level of risk.

Evolution of Comanche into a network-centric Objective Force helicopter should occur by the FRP decision. Based on the remaining software concurrency and complexity, it will be challenging for the Army to produce Block 2 or Block 3 aircraft in the currently projected timelines of FY10 and FY11, respectively.

- **Performance and Weight.** There has been weight growth of 675 lbs since Milestone II, which is attributed mainly to the redesign of drive train components. To offset weight growth, engine power output has been increased 100 shaft horsepower, but at the expense of engine life (3,400 to 2,800 hours). At the projected weights, Comanche will meet the Key Performance Parameter Vertical Rate of Climb (500 fpm) requirement with little or no margin for additional weight growth or engine power.
- **Software Development, Integration, and Testing.** The Comanche program strategy for integrating and testing mission equipment on the aircraft still entails significant risk. The EMD strategy proposes parallel development and testing of four major software drops before the Block 1 aircraft completes operational testing in FY09. Minimal mission equipment functionality (no armament, radar, aircraft survivability equipment, or digital communications) will be available for the Limited User Test (LUT). Ability to conduct night operations may also be prohibited due to the timing of the required airworthiness release. Primarily developmental testing, as opposed to operational testing, will support the LRIP decision.
- **Antennas.** Antenna placement, design, and performance remain significant program risks to meet some antenna performance goals. Also problematic is the translation of antenna areas. Testing of LO antennas to date has confirmed that the designs meet RCS goals but fail performance goals in some real world situations. There is concern that flight-testing of EMD antennas cannot be scheduled until FY06, just prior to the LUT. To be a command and control platform, Comanche must have robust antennaperformance.
- **Flight Handling.** The prototype aircraft has demonstrated some undesirable flight handling characteristics including vibration, buffeting and directional stability. However, design changes and flight control software modifications continue to correct these flight-handling anomalies.
- **Comanche Radar.** Design of the Comanche radar antenna in the past two years appears to be maturing, but challenges remain to achieve stationary target detection requirements. At Milestone II, the Comanche radar used an electronically steered array antenna that failed to meet performance requirements. Since Milestone II, the contractor has completed design, assembly, and laboratory testing of a mechanical scanning antenna that employs azimuth and elevation mono-pulse radar waveforms. Laboratory test results suggest that the new design may improve performance as expected.
- **Radar Cross-Section.** Comanche appears to be in a position, based on RCS measurements of a full-scale model, to meet RCS goals in most areas. As expected, technical challenges are emerging that could compromise the demonstrated RCS levels. For example, rain erosion of the polyurethane strips on the fantail blades has prompted a search for dielectric materials for the leading edges of the blades. In addition, materials currently identified for conductive door/skin seals have not achieved the durability and RCS characteristics desired. Materials have not been identified that will produce the desired RCS and withstand the harsh environments common to helicopter operations.
- **Command and control software and employment concepts.** The software that enables wideband digital communications will not be delivered until late in EMD. Achieving real-time digital interoperability will not likely occur on Block 1 aircraft.

The LFT&E program is scheduled to be completed before FRP decision (FY10). It includes component qualification and subsystem level ballistic testing for over 20 critical components, as well as dynamic testing on the full-up production-representative aircraft. Because of the late (FY08) delivery of the LFT&E aircraft, correction of vulnerabilities discovered during LFT&E will be difficult to implement on initial production aircraft.